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PRIVATELY OWNED MINE RESCUE STATIONS

BY

R. D. CURRIE AND C. W. OWINGS

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PRIVATELY OWNED MINE-RESCUE STATIONS[1]

By R. D. Currie[2] and C. W. Owings[3]

Privately owned mine-rescue stations are maintained by many metal and coal mining companies throughout the United States. The object of maintaining the stations is to have on hand equipment that may be used in case of a mine fire or mine explosion. To be of value, rescue equipment must be in readiness for immediate use in case of a fire or explosion, but unfortunately this ideal condition is not found in the majority of the privately owned stations. Frequently several thousand dollars are expended for rescue equipment and supplies and then practically no attention is given to the proper up-keep of the equipment. It is believed that such neglect is usually due to the fact that responsible executives are not acquainted with the essential requirements of making these stations effective; therefore an understanding of the more common defects noticed in and around privately owned rescue stations may be a means of awakening mine executives to the necessity of keeping mine-rescue equipment in a safe condition at all times.

Storage of apparatus is given relatively little attention by most mining companies in spite of the fact that rubber parts deteriorate rapidly, especially when held under unfavorable conditions. During the inspection of mine-rescue equipment owned by mining companies, representatives of the Bureau of Mines much too frequently find the rubber parts of apparatus unfit for use chiefly because of improper methods of storing. Occasionally the rubber breathing bag becomes cracked and leaks; frequently rubber hose becomes dry, loses its elasticity, and leaks; and rubber mouth pieces become dry, check, and are then not only useless but definitely dangerous if they are worn. Most of these defects result from failure to observe the simple rule that all rubber parts should be stored in a cool dark place, preferably in relatively moist air with a humidity of from 40 to 60 per cent. Frequently rescue apparatus are stored in loosely constructed wooden closets built over or adjacent to steam pipes, and it is exceptional to find the apparatus stored in a place in which wet sponges or other humidifying devices are used or if used are kept in a wet condition. If the equipment is stored in trunks supplied by the manufacturers a sponge kept moist will render the air sufficiently humid; if storage is in a specially constructed cabinet, a glass or dish of water will keep the air humid provided, of course, <u>water</u> is kept in the glass or dish, but unfortunately this is not always done. Proper storage is one of the chief means of keeping apparatus in a safe working condition.

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1 The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6304."

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The caps on the regenerator should be cleaned thoroughly when stored away. The threads of both caps and of the regenerator, should be cleaned with a wire brush. The cardoxide dust if dampened in use forms a natural cement which unless removed tends to rust and makes it difficult to unscrew the caps. In one rescue station three out of five regenerator caps had rusted tightly in place so that it was necessary to place the caps in a vise to unscrew them; in doing this the threads were damaged and had to be repaired before reliance could be placed on them. In a number of other instances the caps have rusted so tightly that the threads have been damaged in unscrewing them.

Oxygen bottles should be stored with nearly the maximum pressure of oxygen in them. Many of the oxygen bottles examined by bureau engineers have contained only about half of the oxygen pressure they should contain; in some cases the bottles are empty due to the fact that the main valve leaks. A new gasket is generally all that is needed to place the valve in good condition. In one case the oxygen bottles on the five apparatus in a station were in unsafe condition and the three extra bottles were also out of order. These defects in the bottles had been reported by the bureau engineer about a year before, yet no effort had been made to make repairs.

Reducing valves very often do not operate properly and some people make the mistake of attempting to regulate the valves. They are delicate pieces of mechanism and should be returned to the manufacturer for repairing or testing and calibrating. In one rescue station three out of five reducing valves were out of order, probably due to the fact that the man in charge had tampered with them.

Seldom are the oxygen pumps found to be in working order. The most usual defect is in the packing, which becomes dry and fails to hold the vacuum during pumping. No oil or grease should be used on any part of an oxygen pump, as spontaneous combustion or an explosion may take place, the piston rod and the leather gaskets should be kept moist with a mixture of one part of glycerin, free from acid, to from 4 to 10 parts of distilled water. The Draeger pump should have four parts of water and the Fleuss pump 10 parts of water to one part of glycerin. The pump should be inspected at least every two weeks to insure that the parts will not become dry. The pumps should be covered with a piece of canvas or rubberized cloth, or similar protection should be provided. Very few oxygen pumps in the privately owned stations are covered and on many of them dirt settles, with special damage to the piston rod and packing glands; when the pump is operated the dirt works into the parts, thereby destroying them or making the pump leak.

All mine-rescue equipment should be carefully inspected and tested by an experienced person at least once a month to assure that it will always be ready for immediate use. Worn-out or deteriorated parts should be replaced, and all parts should be tested to be sure that they are in good working order. One competent man should be given positive responsibility for such examination and for the proper working condition of the apparatus.

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For sanitary reasons the mouthpiece and connecting tubes of rescue apparatus should be thoroughly disinfected before and after use, but the disinfectant used should not be injurious to metal, rubber, or fabric. It has been found that one standard bichloride of mercury tablet dissolved in two quarts of water is a suitable disinfectant when applied for 15 minutes. Other disinfectants include a 2 per cent solution of lysol and a 5 per cent solution of formalin.

Light, heat, and water facilities should be provided at the station; water is especially important for cleansing and sterilizing apparatus. Telephone connections to the mines served is desirable, in fact almost a necessity.

Enough trained men to form two or more crews of five men each should be ready to answer any call on short notice. These men should be trained in the care, testing, and wearing of the apparatus in accordance with the schedule of training as prescribed in the 1928 edition of the U. S. Bureau of Mines Handbook on "Self-Contained Oxygen Breathing Apparatus," pages 157 to 164.

The men who form the designated rescue crews should be retrained at least one day each month, and it is advisable that they be re-examined every six months. Men should be physically sound and they should receive semi-annual examinations by a doctor.

The following list of equipment should be considered a minimum for any station:-

- 5 complete self-contained oxygen breathing apparatus of a type approved by the Bureau of Mines. (10 complete apparatus if only one station is maintained).
- 1 extra reducing valve.
- 1 extra small oxygen bottle for rescue apparatus.
  Extra mouthpieces, breathing tubes, breathing bags, by-pass tubes, gaskets, and other parts for repairing apparatus.
- 5 cylinders of compressed oxygen, 100 cubic foot capacity.
- 6 approved, magnetically-locked type, flame safety lamps, with repair parts.
- 12 approved type, flash lights, cap lamps or hand lamps. Charging rack and facilities for electric cap lamps or hand lamps if used.
- 1 oxygen pump, hand or power driven, with extra gaskets and repair parts.
- 1 1,000-foot life line and reel.
- 2 canary birds with small portable cages.
- 1 carbon monoxide detector.
- 1 Orsat apparatus for analyzing gases and 6 gas sampling tubes or bottles.
- 1 oxygen inhalator.
- 100 cans regenerator material.

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Only in four cases were methane indicators provided and in two of these cases they were in need of repairs.

Oxygen pumps were provided in all but one case, but several of these pumps were in poor condition.

Orsat apparatus was provided in five cases, but it is improbable that it was in condition for prompt use.

Pyrotannic acid CO detectors were not provided in any case.

Flame safety lamps were provided in every case.

Mine-rescue telephones were provided at only one station.

Sufficient permissible type flashlights were provided at only three stations.

Sufficient apparatus spare parts were not kept on hand at five stations.

In four cases the training facilities were considered poor or none were provided.

In five cases no training was done except when a Bureau of Mines Instructor or Car visited the mine.

In four cases no smoke-room was provided.

In six cases no training was done underground.

In five cases no instruction was given in artificial respiration.

The average number of men trained at each station was 24.

In only two cases advanced mine-rescue training had been given at the station.

This in general covers the conditions as revealed by these relatively recent inspections. In each case suggestions and recommendations were made for the improvement of the station or of training facilities.

While it is probable that mine-rescue stations established and maintained jointly by several mining companies are more satisfactory in general than are privately owned mine-rescue stations, there is no question that the privately owned mine-rescue station is a necessary institution wherever there is no joint rescue station or State or Federal rescue station within a few miles of the mine. It is decidedly commendable to find so many private stations at metal and coal mines in the United States; however, it is deplorable to find that probably not more than a third of these stations keep the rescue equipment in usable condition or keep a suitable number of employees well trained in the use of the equipment. In the name of safety, it is urgent that greater thought and attention be given to the maintenance of the privately owned mine-rescue stations.

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1 tool box with good assortment of wrenches and other tools.
1 blow torch, soldering iron, solder and flux.
1 master gage.
1 manometer or low-pressure gage.
1 water gage.
1 army type stretcher.
1 first-aid cabinet complete.
1 anemometer.
5 three gallon acid-soda fire extinguishers, or the equivalent.

Some types of gas masks have come into fairly general use in the past few years, and a station's equipment is hardly considered complete without five or more gas masks of the types held applicable to mine use. The same precautions must be taken in caring for the rubber parts of the gas masks as for the oxygen breathing apparatus, and the masks should be so held that they will be accessible for use only by persons who appreciate the construction of these devices when used in mines.

The size of the efficient mine-rescue station and the amount of equipment to be maintained depend on a number of factors, such as:-

1. Number of mines to be served.
2. Distances to be traveled from the station to the mines.
3. The distance from the source of supply where repairs and service can be obtained.

It has been found that most of the stations in the United States are well located with respect to the mines to be served, but the amount of equipment in many cases is inadequate. As heretofore indicated, it has also been found that in many cases the equipment is in unsafe wearing condition and constitutes a serious hazard.

As part of the service given the mining industry by the mine-rescue car personnel of the Bureau of Mines, inspections are made of privately owned mine-rescue stations and equipment and the following defects were noted in the inspection of some of these stations recently:-

Oxygen inhalers were provided in each case except one, but in several cases the inhalers were reported in very poor working condition.

In most cases it was reported that no carbon monoxide detector was provided and generally where one was provided, it was in poor working condition, due chiefly to deterioration of the rubber parts of the device.

No canaries were provided at any of the stations.

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